Plant Communities of Highland Heights Community Park, Cuyahoga County, Ohio[1]

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Abstract. We have described the vegetation structure with respect to various community types of Highland Heights Community Park and adjoining territory. High values of Shannon's Diversity Indexes and Floristic Quality Assessment Indexes indicate a superior quality, species-rich habitat with several high-fidelity species. Based on our research, which reveals that the study site is worthy of conservation and preservation, we suggest recommendations to the city of Highland Heights for park management and land use planning.

OHIO J SCI 106 (5):174-180, 2006

INTRODUCTION

This paper is a continuation of our efforts to document and analyze the flora of Highland Heights Community Park. The study area is a suburban undeveloped park with natural land surrounded by development. The study area exhibits great species diversity (408 taxa) and supports a species (*Solidago puberula*) listed endangered for Ohio (Wilder and McCombs 2002). The diversity of habitats, including shrub swamp, forest, wet meadow, and wooded swamp, makes the site an ideal model for ecological sampling and vegetation analyses.

The City of Highland Heights has a growing interest in green-space, and is undertaking efforts to acquire more park land. In a previous paper (Jog and others 2005), we reported the plant species present in the study area. The intent of this paper is to report the results of quantitative studies of the vegetation, including diversity, floristic quality indices, and community cluster analysis. This study is intended to aid efforts being taken by the City of Highland Heights to acquire the adjoining piece of land for preservation.

Highland Heights Community Park is located in the city of Highland Heights within Cuyahoga County in northeast Ohio. The study area comprises a portion of the park and an adjoining undeveloped natural area, with a total of about 42 ha. Site characteristics, including location, soils, and geology, are reported in detail in Jog and others (2005). The study area has five distinct communities: shrub scrub, shrub-swamp, wet meadow, wooded swamp, and forest (Fig.1).

MATERIALS AND METHODS

Vegetation Sampling

We set up transects within each of the four communities, such that each transect was approximately at the center of the community and ran in a direction parallel to the long axis of the community. However, the central wet meadow was an exception since the transect we set up was diagonal to the long axis of the meadow and ran in a north-northeast, south-southwest direction. This was done to ensure maximum coverage of area. The total number of transects in each community type was as follows: shrub swamp (one), shrub-scrub (one), forest (two), wet meadow (two), and wooded swamp (one).

Equidistant nested plots were set up within each transect and data were sampled based on the Relevé method (Mueller-Dombois and Ellenberg 1974). We set up 17 plots at an inter-plot distance of 9.0 m in shrub swamp and shrub-scrub, 17 plots at an inter-plot distance of 27 m in wet forest, 22 plots at an inter-plot distance of 12 m in wet meadow, and 8 plots at an inter-plot distance of 27 m in wooded swamp. The number of plots was determined when we reached a plateau on the species-area curve, indicating that a vast majority of species was included. Trees were measured for diameter at breast height (DBH) and recorded if their diameter was 10 cm or greater. Sampling of data was done within each plot three times during the growing season of the year 2002 to account for temporal changes in vegetation. Percent cover of each species for each subtype was visually assessed and recorded in each plot. Meander surveys were done outside each transect after plot sampling to record outlier species. Nomenclature of vascular plant taxa follows Kartesz (2004).

Vegetation Analyses

Relative percent frequency, relative density, relative dominance, and importance index were calculated from the plot data. Relative percent frequency was calculated as frequency (number of plots in which species occur) of a species divided by the sum frequency for all species. Relative density was calculated for both trees and shrubs by taking the number of individuals for a species and dividing by the sum of density values for all species in that vegetation type. Relative dominance was calculated only for trees, and was the average dominance (calculated from the DBH) of a tree species for all plots divided by the sum average dominance of

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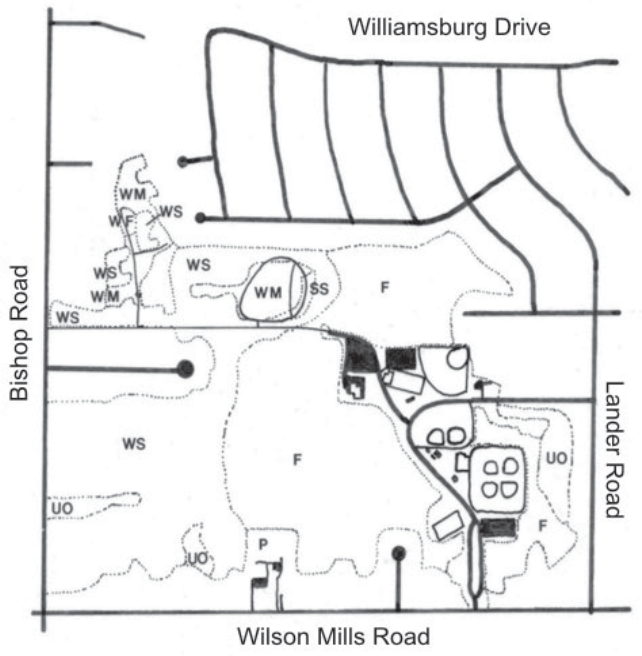

FIGURE 1. Map of the study area redrawn from aerial photographs in 1998 (Jog and others 2005). Bold lines indicate existing roads. Light lines indicate paths. Dotted lines indicated subtype boundaries. Filled areas indicate parking lots or cul-de-sacs. F = Deciduous Forest, P = Pet Cemetery, S = Shrub-Scrub, SS = Shrub Swamp, WM = Wet Meadow, WS = Wooded Swamp, UO = Urban Open Land, and UR = Urban Recreation.

all tree species for all plots. The importance index of each species was calculated by totaling all the above values (Mueller-Dombois and Ellenberg 1974). For trees, total possible value was 3.0, for shrub 2.0, and for herbs 1.0. For reporting purposes, species with very low importance values were eliminated from the tables (Tables 1-4) as follows: ≤0.09 for trees, ≤0.06 for shrubs, ≤0.03 for herbs. The percent cover data were averaged for each of the four wetland subtypes and subsequently used to create a cluster dendrogram based on percentage distance (PD) (Pielou 1984). Shannon's Diversity Indices were calculated for each subtype (Ludwig and Reynolds 1988).

Floristic Quality Assessment Index (FQI)

The FQI values for each wetland subtype were calculated based on the Coefficient of Conservatism (C of C) assigned to species. These values were obtained from Andreas and others (2004) and the FQAI was calculated according to the following formula from Andreas and Lichvar (1995): $I = R/\sqrt{N}$, where I = floristic quality assessment index, R = sum of coefficients of conservatism for all plants recorded in the area, and N = number of different native species recorded. Species that did not have values assigned to them were not considered in the equation. In addition, the modified floristic quality assessment index for each community type was also calculated as modified FQAI = C, where C is the mean coefficient of conservatism (Rooney and Rogers 2002).

Soil Analysis

We sampled soil at three locations within each transect—one sample at the center and one sample

TABLE 1

Vegetation sampling data for deciduous forest. Rare species have been excluded as indicated in the methods. The species with highest importance values in each group are given in bold. Groups are based on life form, that is, trees, shrubs, and herbs.

	RDO*	RDE*	RF*	I*
Trees				
Acer rubrum	0.07	0.09	0.09	0.25
Acer saccharum	0.05	0.4	0.2	**0.65**
Carya cordiformis	0.07	0.03	0.06	0.16
Carya ovata	0.08	0.03	0.07	0.18
Fagus grandifolia	0.06	0.16	0.11	0.33
Fraxinus sp.	0.08	0.04	0.09	0.21
Liriodendron tulipifera	0.12	0.02	0.04	0.16
Quercus palustris	0.16	0.02	0.04	0.22
Quercus rubra var. *ambigua*	0.06	0.06	0.06	0.18
Tilia americana	0.07	0.09	0.11	0.27
Ulmus americana	0.04	0.03	0.07	0.14
Shrubs				
Acer saccharum		0.24	0.17	0.41
Asimina triloba		0.06	0.02	0.08
Carpinus caroliniana		0.06	0.08	0.14
Fagus grandifolia		0.09	0.12	0.21
Frangula alnus		0.03	0.06	0.09
Fraxinus pensylvanica var. *subintegerrima*		0.09	0.10	0.19
Lindera benzoin		0.26	0.21	**0.47**
Prunus serotina		0.09	0.12	0.21
Herbs				
Arisaema triphyllum ssp. triphyllum			0.06	0.06
Boehmeria cylindrica			0.09	**0.09**
Carex rosea			0.04	0.04
Cinna arundinacea			0.04	0.04
Galium tinctorium			0.04	0.04
Glyceria striata			0.04	0.04
Impatiens capensis			0.08	0.08
Poa trivialis			0.04	0.04
Podophyllum peltatum			0.08	0.08
Polygonum virginianum			0.09	**0.09**
Quercus rubra var. ambigua			0.04	0.04
Scutellaria lateriflora			0.04	0.04
Toxicodendron radicans			0.06	0.06

*Columns are coded as: RDO = relative dominance, RDE = relative density, RF = relative percent frequency, I = importance index.

TABLE 2

Vegetation sampling data for wooded swamp. Rare species have been excluded as indicated in the methods. The species with highest importance values in each group are given in bold. Groups are based on life form, that is, trees, shrubs, and herbs.

	RDO*	RDE*	RF*	I*
Trees				
Acer rubrum	0.09	0.31	0.13	**0.53**
Acer saccharum	0.07	0.01	0.03	0.11
Carpinus caroliniana	0.03	0.11	0.10	0.24
Carya cordiformis	0.04	0.11	0.10	0.25
Carya ovata	0.13	0.16	0.13	0.42
Fraxinus sp.	0.07	0.11	0.13	0.30
Malus sp.	0.09	0.01	0.32	0.14
Nyssa sylvatica	0.13	0.01	0.03	0.18
Ostrya virginiana	0.05	0.05	0.07	0.16
Pinus strobus	0.09	0.01	0.03	0.14
Prunus serotina	0.06	0.06	0.13	0.25
Ulmus americana	0.06	0.02	0.03	0.12
Shrubs				
Carpinus caroliniana		0.10	0.12	0.21
Carya cordiformis		0.04	0.12	0.16
Carya ovata		0.04	0.08	0.12
Fagus grandifolia		0.02	0.08	0.10
Frangula alnus		0.30	0.15	**0.45**
Fraxinus sp.		0.12	0.08	0.20
Prunus serotina		0.04	0.08	0.12
Rosa multiflora		0.22	0.04	0.26
Viburnum recognitum		0.05	0.12	0.17
Herbs				
Arisaema triphyllum ssp. *triphyllum*			0.06	0.06
Carex swanii			0.06	0.06
Carex sp.			0.06	0.06
Circaea lutetiana			0.06	0.06
Impatiens capensis			0.13	0.13
Lonicera sp.			0.06	0.06
Parthenocissus sp.			0.13	0.13
Polygonum virginianum			0.06	0.06
Rosa multiflora			0.19	**0.19**
Rubus sp.			0.06	0.06
Toxicodendron radicans			0.13	0.13

*Columns are coded as: RDO = relative dominance, RDE = relative density, RF = relative percent frequency, I = importance index.

TABLE 3

Vegetation sampling data for shrub swamp. Rare species have been excluded as indicated in the methods. The species with highest importance values for each group are given in bold. Groups are based on life form, that is, shrubs and herbs.

	RDE*	RF*	I*
Shrubs			
Cornus amomum	0.64	0.17	**0.81**
Frangula alnus	0.04	0.11	0.15
Fraxinus americana	0.02	0.06	0.08
Lindera benzoin	0.09	0.11	0.20
Rosa multiflora	0.04	0.11	0.15
Tilia americana	0.02	0.06	0.08
Toxicodendron radicans	0.02	0.06	0.08
Viburnum recognitum	0.13	0.33	0.46
Herbs			
Carex tribuloides		0.06	0.06
Epilobium sp.		0.04	0.04
Eupatorium perfoliatum		0.08	0.08
Glyceria striata		0.10	0.10
Impatiens capensis		0.15	**0.15**
Leersia oryzoides		0.06	0.06
Onoclea sensibilis		0.08	0.08
Polygonum sagittatum		0.06	0.06
Poa trivialis		0.13	0.13
Solanum dulcamara		0.04	0.04

*Columns are coded as: RDE = relative density, RF = relative percent frequency, I = importance index. No trees were abundant enough to be ranked in this table.

each, approximately equidistant from the center in both directions. Samples were taken from the A horizon, about 12 in below the surface. These were then analyzed for dry bulk density, moisture content, and pH. Bulk density was measured according to the methodology prescribed by the Soil Conservation Service (1984). Water content of soil was calculated on a mass basis as a percentage of the mass of dry soil according to the protocol by Topp (1993). Soil pH in water was measured based on Hendershot and others (1993).

RESULTS

Five community subtypes were found in the park, which were (in order of decreasing area): deciduous forest, wooded swamp, wet meadow, shrub-scrub, and shrub swamp (Fig. 1). Deciduous forest occupied the largest surface area and was at the driest end of the spectrum. Its cover consisted primarily of *Acer saccharum*

TABLE 4

Vegetation sampling data for shrub swamp (west). Rare species have been excluded as indicated in the methods. The species with highest importance values in each group are given in bold. Groups are based on life form, that is, shrubs and herbs.

	RDE*	RF*	I*
Shrubs			
Acer rubrum	0.02	0.10	0.12
Cornus amomum	0.19	0.10	0.29
Frangula alnus	0.38	0.24	**0.62**
Nyssa sylvatica	0.01	0.07	0.08
Quercus rubra var. *ambigua*	0.01	0.07	0.08
Rosa multiflora	0.17	0.03	0.20
Ulmus americana	0.01	0.07	0.08
Viburnum recognitum	0.20	0.21	0.41
Herbs			
Agrimonia gryposepala		0.04	0.04
Agrostis perennans		0.05	0.05
Anthoxanthum odoratum		0.08	**0.08**
Apocynum cannabinum		0.05	0.05
Danthonia spicata		0.04	0.04
Fragaria virginiana		0.04	0.04
Glyceria striata		0.04	0.04
Holcbus lanatus		0.05	0.05
Potentilla simplex		0.05	0.05
Rosa multiflora		0.05	0.05
Solidago altissima		0.05	0.05
Solidago juncea		0.05	0.05
Solidago nemoralis		0.05	0.05
Toxicodendron radicans		0.04	0.04

*Columns are coded as: RDE = relative density, RF = relative percent frequency, I = importance index. No trees were abundant enough to be ranked in this table.

(34%) and *Fagus grandifolia* (11.6%) in the overstory, and *Lindera benzoin* (14%) and *Acer saccharum* (13.1%) in the understory. The herb layer had a predominance of *Polygonum virginianum* (5.7%) and *Carex rosea* (2.7%). Wooded swamp occupied the next largest area and its cover consisted mainly of *Acer rubrum* (28%) and *Fraxinus americana* (12.9%) in the overstory, and *Rosa multiflora* (6.3%) and *Lonicera japonica* (3.8%) in the understory. The herb layer was dominated by *Rosa multiflora* (18.9%). Dominant vegetation in the wet meadow was *Aristida longispica* (21%) and *Rhynchospora capitellata* (7.3%), and dominant ground cover was *Sphagnum* sp. (18.9%). Shrub-scrub was dominated by *Viburnum recognitum* (14%), *Frangula alnus* (14%), and *Cornus amomum* (13%) in the shrub layer, and by *Solidago altissima* (5%) in the herb layer. Shrub swamp, the wettest community, was dominated by *Cornus amomum* (15%) and *Viburnum recognitum* (13%) in the shrub layer, and by *Poa trivialis* (33%), *Glyceria striata* (18%), and *Onoclea sensibilis* (18%) in the herb layer.

Importance index values for all taxa in all subtypes were low. Within the deciduous forest, *Acer saccharum* and *Fagus grandifolia* had the highest values of 0.65 and 0.33, respectively. *Lindera benzoin* and *Acer saccharum* had high importance index values of 0.47 and 0.41, respectively, for the shrub layer. *Polygonum virginianum* and *Boehmeria cylindrica* had the highest importance indices although they were both <0.10.

Acer rubrum and *Carya ovata* had the highest importance index values of 0.53 and 0.42 within the tree layer of the wooded swamp. *Frangula alnus* had the highest importance index value of 0.53 in the shrub layer. The herb layer had *Rosa multiflora* with the highest importance index of 0.19. The wet meadow did not have any species that had markedly high importance indices. *Cornus amomum* and *Viburnum recognitum* had the highest importance indices of 0.81 and 0.46, respectively, in the shrub layer of the shrub swamp. *Frangula alnus* had the highest importance index value of 0.62 for the shrub-scrub. Herbs in the shrub swamp had similar importance indices that were all low. Values of importance indices for deciduous forest, wooded swamp, wet meadow, shrub-scrub, and shrub swamp are listed in Tables 1-5, respectively.

All five communities were very dissimilar. The shrub swamp and shrub-scrub communities were only 30.3% similar, differing chiefly in the composition of the herb layer. Wet forest and wooded swamp were weakly similar (19.5%). Wet meadow was the most distinctive community, being 18.2% similar to the west shrub swamp, but only 6.3% similar to the east shrub swamp, 5.0% similar to the wooded swamp, and 0.2% similar to wet forest. The cluster dendrogram based on Czekanowski's percent similarity shows the weak relationships among these very different wetland subtypes (Fig. 2). Shannon's Diversity Index values were: shrub swamp = 2.6, shrub-scrub = 2.9, wet meadow = 3.26, wooded swamp = 2.86, and forest = 2.94.

Floristic Quality Assessment Index (FQI)

FQI values obtained were: shrub swamp = 15, shrub-scrub = 21, wet meadow = 29, wooded swamp = 29, and deciduous forest = 40. Modified FQI values were: shrub swamp = 2.63, shrub-scrub = 2.94, wet meadow = 1.99, wooded swamp = 3.65, and deciduous forest = 3.79

Soil Analysis

The shrub swamp had significantly higher moisture content than any other area measured, with a mean of 60.28 ± 7.22% (Table 6). Soil sampled within the wooded swamp also had moderately high moisture content, with a mean of 38.45 ± 4.04%, which was significantly higher than all other sites except the shrub-scrub. All other

TABLE 5

Vegetation sampling data for wet meadow. Rare species have been excluded as indicated in the methods. The species with highest importance values are given in bold.

Species	RF*	I*
Herbs		
Acer rubrum	0.04	0.04
Apocynum cannabinum	0.04	0.04
Aristida longispica	0.05	0.05
Bidens poylepis	0.04	0.04
Danthonia spicata	0.05	0.05
Polygala sanguinea	0.04	0.04
Potentilla simplex	0.06	**0.06**
Rhamnus frangula	0.04	0.04
Solidago graminifolia	0.04	0.04
Ground Cover		
Lichen	0.02	0.02
Polytrichum commune	0.01	0.01
Sphagnum sp.	0.03	0.03

*Columns are coded as: RF = relative percent frequency, I = importance index. No trees or shrubs were abundant enough to be included in this ranking.

sites had moisture contents that were not significantly different from one another (Table 6).

Soil pH in the shrub swamp was also significantly different from all other sites, with a mean of 6.48 ± 0.38 (Table 6). The other sites were more acidic, with means ranging from 4.64 to 5.25. Bulk density values were all <1.3 g/cc (Table 6).

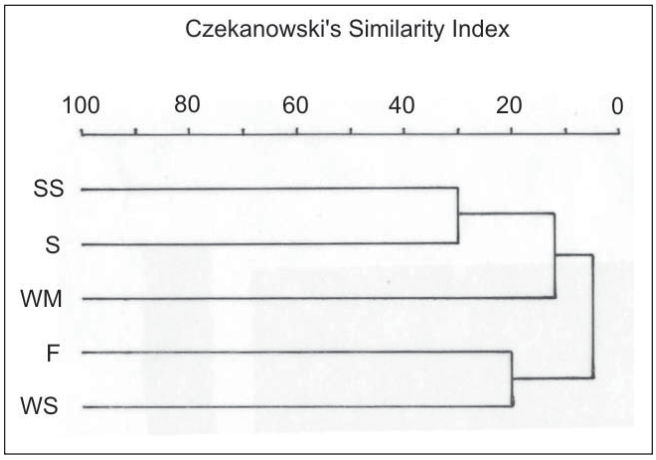

FIGURE 2. Cluster dendrogram representing relationships between wetland subtypes. SS = Shrub Swamp, S = Shrub-Scrub, F = Deciduous Forest, WM = Wet Meadow, and WS = Wooded Swamp.

DISCUSSION

The study site exhibits high species diversity both in terms of species richness and species evenness in each wetland subtype. For a complete list of vascular plant taxa, see Jog and others (2005). We found highest species richness in the deciduous forest, which had the largest area (172 taxa). The wet meadow also had high richness (158 taxa). Wooded swamp, shrub swamp, and shrub-scrub had 106, 46 and 74 species, respectively.

Relative dominance, relative density, relative frequency, and importance index values reveal that the communities are not dominated by any single species (indicative of high species evenness). Low values of Czekanowski's index of similarity showed that vegetation within each subtype were markedly different from vegetation within other subtypes (Fig. 2). The pronounced diversity in habitat was one factor that contributed to the high species diversity within the park. Shannon's Diversity Index values for all subtypes were moderately high. This reflects that these communities not only have a large number of species, but that the species are evenly distributed within each community. Within our study area, the wet meadow scored the highest values for this Shannon's Diversity index, although this habitat was small in size. A floristic study (Delong and others 2005) in another urban natural area remnant in Cuyahoga County revealed a lower range of values (1.48 to 3.04). Their site was a highly disturbed suburban wetland of considerably smaller size and more limited soil types.

FQI is calculated using C of C values which range from 0-10, with higher values indicating plants with higher fidelity to specific habitats. Low value plants are tolerant to many different conditions, and are typically weedy generalists. Exotic taxa are all assigned a value of 0. Invasive natives are likewise assigned a value of 0. Plants with a score of 1-3 occur in a variety of habitats.

TABLE 6

Soil sampling data. Means (mean ± SE) in columns are significantly different (= 0.05) if they do not share common letter superscripts.

	Bulk Density (g/cc)	Moisture Content (%)	pH
Shrub Swamp	0.57^{c} ± 0.08	60.28^{a} ± 7.22	6.48^{a} ± 0.38
Shrub Scrub	1.04^{a} ± 0.11	14.66^{c} ± 0.13	5.25^{b} ± 0.11
Deciduous Forest			
North	$0.74^{b,c}$ ± 0.90	15.47^{c} ± 2.75	4.64^{b} ± 0.05
South	$0.09^{a,b}$ ± 0.15	24.44^{c} ± 3.70	4.96^{b} ± 0.19
Wet Meadow			
East	1.09^{a} ± 0.04	18.77^{c} ± 2.12	4.72^{b} ± 0.10
West	1.08^{a} ± 0.08	15.67^{c} ± 1.29	5.15^{b} ± 0.26
Wooded Swamp	$0.71^{b,c}$ ± 0.07	38.45^{b} ± 4.04	4.95^{b} ± 0.40

Those with scores of 4-6 are associated with a specific plant community but tolerate moderate disturbance, while those with scores of 7-8 are associated with a community of advanced successional stage. High fidelity plants have scores of 9-10.

FQI values for wet meadow and wooded swamp were moderately high (29, 29, respectively), while the forest scored a high value (40). FQI values for both shrub swamp as well as shrub-scrub were relatively low, which is likely due to their small size and low species richness. The shrub swamp has fewer disturbance indicators, such as invasive species and exotics, than the shrub-scrub, and has soils that are also significantly different (wetter, lighter, and less acidic). It is noteworthy to mention that when the modified FQI was calculated, which is based solely on coefficients of conservatism, the results were quite different. Higher values were obtained for the deciduous forest and wooded swamp (3.79 and 3.65), while the other communities had somewhat lower values. These values can be explained by the higher number of conservative taxa present in these communities. Deciduous forest had 20 taxa with coefficients of conservatism ≥6, while the wooded swamp had ten such taxa. The number of such taxa in the wet meadow was nine, while that in the shrub-scrub was only four and in the shrub swamp, three. For the entire study area, the FQI was 51 (FQI increases as species richness increases, provided a similar proportion of conservative species is present). Case studies done in Ohio by Andreas and Lichvar (1995) in an old field, degraded prairie and in a high quality prairie yielded FQI values of 8, 28, and 50, respectively. A study done by Delong and others (2005) at the aforementioned disturbed wetland yielded values ranging from 15 (emergent marsh) to 23 (disturbed shrub swamp). Given the range of values seen in other Ohio sites, Highland Heights Community Park has surprisingly high floristic quality given its very urban location.

FQI is calculated using coefficient of conservatism values, so it is interesting to note those species with C of C ≥7. These were *Aristida longispica*, *Carex prasina*, *Caulophyllum giganteum*, *Epifagus virginiana*, *Fagus grandifolia*, *Fraxinus nigra*, *Magnolia acuminata*, *Prosartes lanuginosa*, *Pedicularis lanceolata*, *Sambucus racemosa* ssp. *racemosa*, and *Viola blanda*. The deciduous forest had the most mature plant community, with several very old and large trees indicating greater age than the adjoining wooded swamp. It supported native trees and herbs that are highly site-specific. The deciduous forest also occupied a large area, which contributed to the higher presence of native species. All these factors contributed toward the high FQI value for the deciduous forest. All community types also showed a presence of exotic species, especially around disturbed areas and along the periphery of each community. However, this did not alter the values of FQI as it does not take alien species into consideration.

Bulk density of soil is an indicator of how well plant roots are able to extend into the soil. We obtained values that were all <1.3 g/cc, indicating that the soil is coarse-silty loam. All these values were lower than the root limiting and restriction-initiation values for loamy soil. Low values also indicate that the soil is fertile and does not inhibit plant growth (Soil Conservation Service 1984). The shrub swamp had lower bulk density than all other sites, with a mean of 0.57 ± 0.08 g/cc. This bulk density was significantly lower than that at the shrub-scrub, south wet forest, and wooded swamp (Table 6). High moisture availability in the soils of the shrub swamp may contribute to the high number of obligate wetland indicator species supported in the shrub swamp.

Based on our studies we conclude that the entire wetland complex in Highland Heights Community Park is worthy of preservation. The high species diversity and presence of conservative species (that is, native species with conservation value) make the site valuable as a preserve and as an educational area. The research site also serves as a natural habitat for wildlife and supports an endangered species of goldenrod (*Solidago puberula*), which is not known to occur anywhere else within the state of Ohio (Jog and others 2005).

Currently, some of the areas with the highest natural area and green space value are not part of the park property. Park property consists of the wooded swamp, deciduous forest, and urban recreational lands south of the path running from Bishop Road to the parking lot in the northwest corner of the urban recreational land (Fig. 1). This excludes some of the most valuable natural space, including all of the shrub swamp and wet meadow communities. The city is exploring the acquisition of an additional 12 ha (30 acres) that would include the shrub swamp, wet meadow, and deciduous forest north of the main part of the park. The northwest corner of our study site is private land (Fig. 1), and is not part of any immediate acquisition plans.

If the city acquires the additional land, pressure will exist to develop at least a portion of it for recreational use and/or parking. The deciduous forest in the northeast portion of the study site (F1) has the least valuable plant diversity. We recommend that if development must take place, this is the area where it should occur. The alternate area for development is the deciduous forest (F2) along Forest Parkway, the road forming the boundary line between the urban recreational area and the southern portion of the wet forest community (Fig.1). We recommend against developing this portion of the park as many of the more conservation-worthy taxa occur in the southern portion of the wet forest, such as *Dicentra canadensis*, *Panax trifolium*, *Trillium grandiflorum*, and *Viola blanda*.

We recommend the preservation of the wet meadow and shrub swamp along with a buffer zone around each subtype. This natural area is currently owned by Mayfield School District. The educational value of this land is high, and if it were protected from development could become the site of long-term studies for classes in the nearby high schools and colleges. The meadow has been maintained as an open space for as long as we have aerial photos of the region (Jog and others 2005). Programs at the local schools could be undertaken to

remove invasive species, including *Frangula alnus*, *Acer rubrum*, and *Lythrum salicaria*, making inroads in the park. Additional protective management practices would be the placement of metal posts to obstruct vehicular traffic, which currently consists of problematic recreational vehicles from adjoining residences.

The natural area of Highland Heights Park could be preserved as a resource for generations to come. Hopefully, it will be well managed and serve as an important island of green space in a sea of development. We have delineated parts of the property as a wetland and made a jurisdictional determination. As a wetland protected under Section 404 of the Clean Water Act, justification for preservation can be made. It is interesting to see such high floristic diversity and quality in an area that has had encroaching development for so many years. We feel such areas should be preserved throughout the country, particularly in the heavily developed region of northeast Ohio.

ACKNOWLEDGMENTS. We thank Dr. B. K. Andreas for sharing the new FQI values. We also thank Dr. Fontes and Dr. Kordula for use of lab facilities for soil analysis. We are grateful to Tom Sampliner, James Bissell, and the Native Plant Society of Northeast Ohio for help rendered in conservation efforts, and to Cleveland State University for financial support.

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